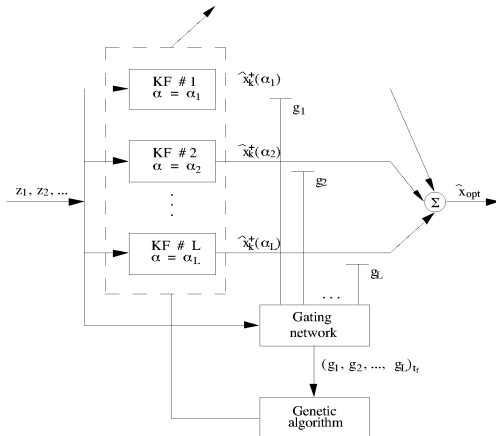
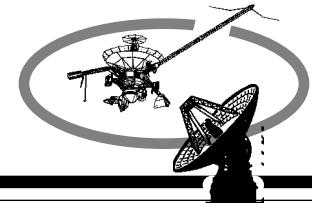
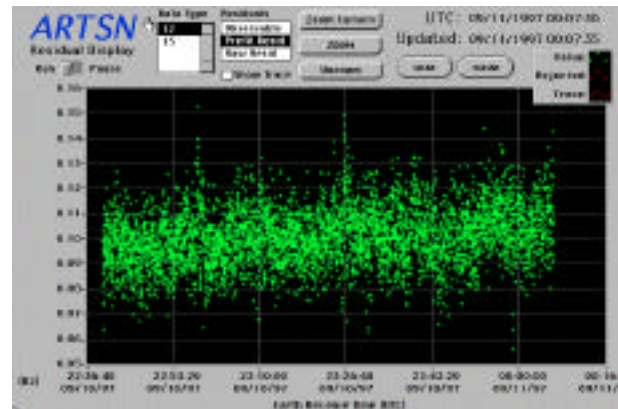


Navigation Work Area



Adaptive Orbit Determination

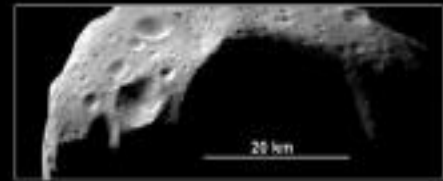


Automated Deep Space Orbit Determination

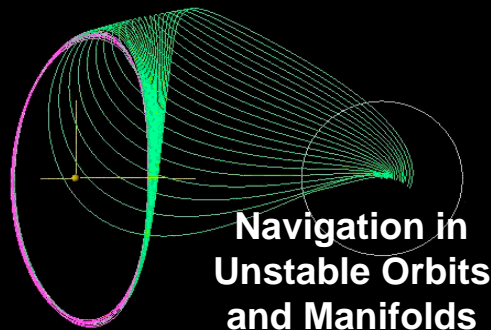
- High-Fidelity navigation algorithms
- Navigation planning and support
- Navigation System Design
- Automated data conditioning
- Real-Time Software Design
- Automated Trajectory Design
- Automated Maneuver Design

Skills leading to techniques that improve navigation capability

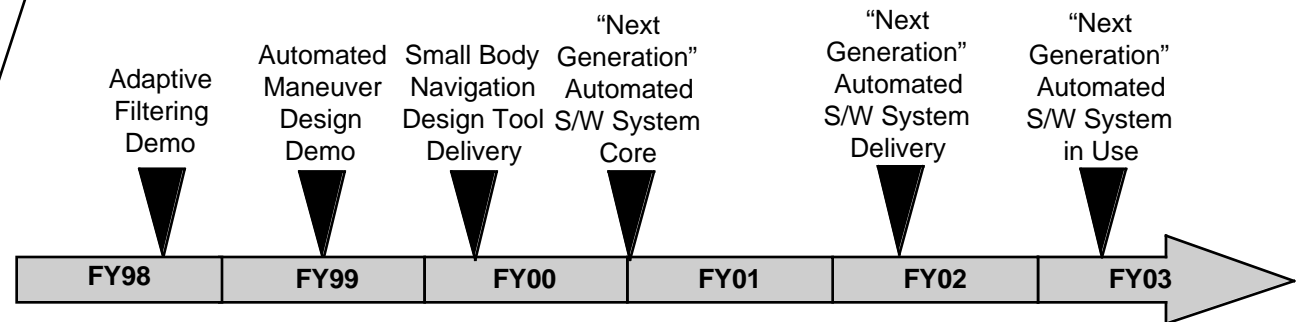
- Skills leading to
- Systems for ground-based and on-board autonomous navigation efforts
 - Low-cost methods that streamline DSN navigation operations



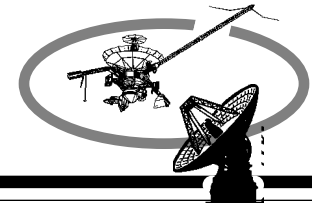
Navigation at Small Bodies



Navigation in Unstable Orbits and Manifolds



High-Level Timeline



Radio Metric Tracking



- **Develop/demonstrate/transfer new technology for autonomous positioning and navigation**

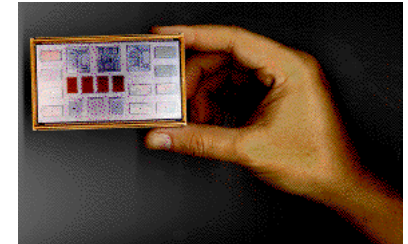
- GPS technology for near-Earth
- GPS-derivatives for deep space/interplanetary
- Autonomous spacecraft with onboard navigation
- Autonomous Formation Flyer (AFF) sensor
- Differential & same-beam tracking techniques

- **Goals and Products**

- μ GPS bit-grabber receiver (< 0.1 watt)
- Real-time software system for GPS positioning
- Industry partnerships and technology thrusts
- Real-time deep space systems for autonomous navigation, formation flying, rendezvous, orbiter/lander
- Planetary ephemeris: 5 nrad Mars, 20 nrad Jupiter
- 1-m orbiter, lander positioning



Precision, automated GPS software and positioning systems



Advanced flight hardware for autonomous spacecraft nav

